VIDEO/FILM CAMERA

The invention relates to the field of cameras.

The American patent US 4797734 describes a camera comprising a shutter with an exposure time by which it is possible to photograph very fast-moving objects

To obtain the best possible shots, it is important for the user to frame his image properly throughout the shooting.

The German utility model DE U 90 13698 describes a camera with three optical channels: a film channel, a viewfinder channel and a photoelectric-effect sensor channel, the light being distributed between the different optical channels by means of a reflecting shutter and a semi-reflecting plate.

In the prior art, there are video cameras with an electronic viewfinder located downline from photoelectric-effect sensors. Now, these sensors usually have a field that is the same as the useful field recorded in the camera. In this case, it becomes impossible to have access to a view outside the field of these sensors. This off-field view would enable the user to anticipate obstacles before they appear in the useful field of the observed scene.

For this purpose, the invention uses an optical viewfinder placed in that part of the camera which is located upline from the sensors.

According to the invention, there is provided a camera according to claim 1.

According to a preferred embodiment of the invention, there is provided a shutter comprising a rotational element comprising at least one mirror part corresponding to its closed position and at least one aperture part corresponding to its open position.

The invention will be understood more clearly and other features and advantages shall appear from the following description and the appended drawings, given by way of non-restrictive examples, of which:

- Figure 1 gives a schematic view of the architecture of a camera according to the invention,

- Figure 2 gives a schematic view of an embodiment of a shutter according to the invention along the sectional plane AA of Figure 1,

- Figure 3 gives a schematic view of another embodiment of a shutter according to the invention along the sectional plane AA of Figure 1.

Figure 1 gives a schematic view of the architecture of a camera according to the invention.

The camera has an optical axis 14 shown in dots and dashes. The path of the light rays is shown by means of solid-line arrows while the direction of the arrows indicates the direction of propagation of the rays.

The camera has an objective support 1 designed to receive an objective 15 shown in dashes. Downline from the objective support 1, there is an objective focal plane 4 that corresponds to the focal plane of the objective 15 which will be used by the camera. This objective focal plane 4 is common for the different spectral components of the light coming from the observed scene. The camera is preferably designed to be used with a category comprising several objectives having the same extension, namely the distance d between the objective support 1 and the objective focal plane 4. This distance then remains the same for all objectives of this category. These objectives will preferably correspond to one and the same format, for example the Super 16 mm format. These objectives may also correspond to other formats such as for example the 35 mm format.

Between the objective support 1 and the objective focal plane 4, there is a shutter 2. In the open position, the shutter 2 lets through light, coming from the observed scene through an objective 15 mounted in the camera, towards the objective focal plane 4. In the closed position, the shutter 2 is reflective and reflects the same light by orienting it towards an optical viewfinder 3. Preferably, the camera has at least one mode in which the switching between the open position and the closed position is periodic, the switching period being smaller than the duration of the retinal persistence. The smaller this switching period with respect to the duration of retinal persistence, the greater is the visual comfort to the user at the optical viewfinder 3. The shutter 2 preferably has a rotative element 20 comprising at least one mirror part corresponding to its closed position and at least one

aperture part corresponding to its open position. The rotative element 20 is advantageously mounted on a rotational axis 27 as in Figure 1. The shutter 2 shall be described in detail further below with reference to Figures 2 and 3.

The optical viewfinder 3 is located off the optical axis 14. It therefore does not receive light from the observed scene except when this light is reflected by the shutter 2 when the latter is in a closed position. The optical viewfinder 3 is preferably in a direction orthogonal to the optical axis 14. This then causes the shutter 2 to be oriented at an angle of 45° with respect to the optical axis 14 as in Figure 1. The optical viewfinder 3 is a viewfinder used for viewing outside the field of the sensors, i.e. it enables vision over a wide field including the useful field which will be the image portion of the observed scene received by the sensors as well as a part of the space surrounding this useful field.

Downline from the objective focal plane 4, there is a spectral splitter 6. The spectral splitter 6 splits the light received from the observed scene into three light components which for example may be red, green and blue. This spectral splitter 6 preferably has several attached prisms with dichroic treatment at the interfaces to geometrically separate the light components. With this spectral splitter 6, three sensors 7, 8 and 9 are associated. Each of the three light components follows a different geometrical path when crossing the spectral splitter 6 to reach one of the three sensors 7 to 9. For the sake of clarity, only the light rays that get focused on the sensor 8 are shown. The optical paths followed by the three light components, between the input of the spectral splitter 6 and the focal planes of the sensors 7 to 9 are also different. The three light components are respectively focused on the sensors 7 to 9. For example, in the preferred case of a splitting into red, green and blue, the red component is focused on the sensor 7, the green component on the sensor 8 and the blue component on the sensor 9.

An adapter 5 located between the objective focal plane 4 and the spectral splitter 6, matches the objective focal plane 4, which is common to all the light components, with the different focal planes of these sensors, in taking account especially of the optical corrections designed to compensate for the aberrations due to the crossing of the spectral splitter 6. Preferably, the geometry of the spectral splitter 6 is such that each sensor is located on

a different axis of a referential system whose original point is inside the spectral splitter 6. For example, in Figure 1, if the axis X designates the optical axis 14, the sensor 8 is on the axis X, namely in the prolongation of the optical axis 14, the sensors 7 and 9 are respectively on the axes Y and Z which are two axes approximately located in a plane orthogonal to the optical axis 14 as in Figure 1.

The sensors 7 to 9 are photoelectric-effect sensors that convert the light components received in their focal plane into electrical signals. These sensors are advantageously matrix sensors, i.e. they consist of a large number of elementary detectors which, all together, cover the useful field of the observed scene. These electrical signals are then conveyed to electronic processing means 10 by means of electrical links. In Figure 1, the electrical links are shown indicated by arrows in dashes, the direction of the arrow indicating the direction of flow of information conveyed by these electrical signals. The processing means 10 process this information before transmitting it to operating means 11 which may for example be either recording means or display means such as a display screen to display the synthesis of the three light components after they pass into the processing means 10. The processing means 10 read the information elements coming from the sensors 7 to 9. This reading is preferably periodic. Generally, the reading period will remain smaller than the switching period of the shutter 2 so that the sensors 7 to 9 illuminated in an open position of the shutter 2 are read before being again illuminated in the next open position of the shutter 2. An open position and a closed position in succession constitute a shutter cycle.

The shutter 2 is controlled by an automatic control device 12 at a given rotational speed, VR for example. The axis of rotation 27 is extended in Figure 1 by dashes up to the automatic control device 12. The preferred shutter 2, described here above, which comprises a rotative element 20, shall be considered throughout the remainder of this document unless otherwise stated. The automatic control device 12 generally comprises a motor driving the rotative element 20 of the shutter 2. In a possible mode of operation of the camera, the automatic control device 12 is driven by the processing means 10. For this purpose, the processing means 10 send a signal to synchronize the reading of the sensors. This synchronization signal

has a frequency F. The rotational speed VR is proportional to the frequency F. The shutter 2 is then synchronized with the reading of the sensors 7 to 9 by the processing means 10. A sensor 13 of the position of the shutter 2 determines the position, with respect to the optical axis 14, of a mirror part of the rotative element of the shutter 2. The camera is designed to adapt to different types of sensors and especially to all types of CCD (charged-coupled device) whether they are interline devices, frame transfer devices, FIT (frame interline transfer) devices etc. It is enough to adjust the different parameters of the camera, namely the shutter cycle, the frequency F, the rotational speed VR, etc. to the type of CCD. By way of an example, the configurations of the cameras for interline CCD sensors and frame transfer CCD sensors are given here below. For an optimum synchronization of the shutter 2 with the reading of the sensors 7 to 9, the rotative element may be phase-shifted with respect to the synchronization signal. This enables the precise setting of the instant when a mirror part of the rotative element enters the vicinity of the optical axis 14 as a function of the start of the scanning of the sensors 7 to 9 when they are read, for example in the case of what are called interline CCD sensors, namely sensors whose lines are read directly by scanning. The vicinity of the optical axis 14 is that portion of space, around the optical axis 14, that is illuminated by the light coming from the useful field of the observed scene. In the preferred example of what are called frame transfer sensors, namely sensors (usually CCD sensors) where the entire content is transferred in blocks into a buffer memory before being read, the phase-shift is used to make the passage into the vicinity of the optical axis 14 of a mirror part of the rotative element coincide with the transfer of a frame during the operation of reading the sensors. This passage corresponds to a blind instant for the sensors since the light coming from the useful part of the scene is then concealed.

Figure 2 gives a schematic view of an embodiment of the shutter 2 according to the invention according to the sectional plane AA of Figure 1.

The shutter 2 comprises a rotative element 20 mounted on a rotational axis 27 perpendicular to the plane of Figure 2. The rotative element 20 preferably has several mirror parts separated by aperture parts which are empty parts. Figure 2 shows two mirror parts 21 and 22 and two

aperture parts 23 and 24. The mirror parts are for example made of polished aluminium.

When the mirror parts 21 and 22 pass into the vicinity of the optical axis 14, vicinity having been defined here above as the space around the optical axis illuminated by the light of the useful field of the observed scene, the light coming from this field illuminates the mirror parts 21 and 22 at the first illuminated zones 25. Similarly, the aperture parts 23 and 24 are illuminated, when they pass into the vicinity of the optical axis 14, at the second illuminated zones 26 shown in dashes in Figure 2. Rreferably, the first illuminated zones 25 all cover a first angular sector S1 that is substantially identical and the second illuminated zones 26 all cover a second angular sector S2 that is substantially identical. An angular sector S1 that is substantially identical means that this sector S1 is identical for all the zones 25 in the ideal case and that the greater the variation of the sector S1 from one illuminated zone 25 to another illuminated zone 25, the greater is the deterioration in the quality of the image of the observed scene. The same is true for the angular sector S2 with the illuminated zones 26. The ratio between the periods of illumination and the periods of concealment of the sensors corresponds to the ratio S2/S1.

Preferably, the shutter 2 comprises three modes of operation that can be selected by the user: a viewfinder mode corresponding to the fixed rotative element 20 that always has a mirror part 21 (or 22) that intersects the optical axis 14, a video mode corresponding to the fixed rotative element 20 that always has an aperture element 23 (or 24) that intersects the optical axis 14 and a combined mode corresponding to the rotative element 20 in rotation, the mirror parts 21 and 22 intersecting the optical axis 14 in alternation with the aperture parts 23 and 24. The viewfinder mode may be used for localizing. The video mode may be used for recording in conditions of low luminosity. The combined mode may be used by the user to record while at the same time viewing the entire observed scene.

Figure 3 gives a schematic view of another embodiment of the shutter 2 according to the invention along the sectional plane AA of Figure 1.

The shutter 2 has several rotative elements like that of Figure 2. The rotative elements 20 and 30, of which there are advantageously two as in Figure 3, are superimposed and mounted on the same rotational axis 27.

The concealed part of the rotative element 30 is shown in dashes. For the sake of clarity, the illuminated zones are not mentioned here unlike in Figure 2. The rotative element 20 and 30 respectively comprises mirror parts 21 and 22 and 31 and 32 respectively, aperture parts 23 and 24 and 33 and 34 respectively. The mirror parts 31 and 32 preferably cover the same angular sector S1 as the mirror parts 21 and 22. A relative angular offset of the two rotative elements 20 and 30, in such a way that there is partial overlapping between the mirror parts 21 and 31 on the one hand and 22 and 32 on the other hand, is used to make the illumination/darkness ratio of the sensors vary from the value S2/S1, obtained in Figure 2, to the value (S2-S1)/2S1. When the value of this ratio becomes smaller than zero, which may occur if S1>S2, it simply means that the aperture parts have disappeared by being covered by the mirror parts. The angular offset can advantageously be selected by the user.